

OCCASIONAL PAPER

NO.1

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IMPACT AND IMPLICATIONS
OF
OFFICE AUTOMATION

by

J. C. McDONALD

MAY
1964

ECONOMICS AND RESEARCH BRANCH
DEPARTMENT OF LABOUR, OTTAWA

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NOTE

In the course of the research work carried out by the Economics and Research Branch of the Department of Labour in the manpower and industrial relations fields, special studies of a technical and semi-technical nature are undertaken from time to time the full results of which are not included in the regular reports issued by the Branch. For some time, it has been felt that findings of such special studies should be made available to research workers and others for their information and possible use.

This series of occasional papers, therefore, will contain the results of such special studies which would not otherwise be distributed as a part of the regular publication program of the Branch; the main purpose being to provide a means of bringing to the attention of research workers and others the results of studies encompassing a wide range of subjects in the manpower and industrial relations fields.

Further papers in this series will be issued only as and when appropriate research work has reached the point at which publication is warranted.

The authors of these occasional papers will be exploring many aspects of their research findings. It should, therefore, be understood that responsibility for inferences and implications is assumed by the authors and should not necessarily be interpreted as a reflection of official Departmental thinking or policy.

J. P. Francis,
Director,
Economics and Research Branch.



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★ Introduction ★

The introduction of 'office automation' in both its technical and personnel aspects creates a situation of newness and change in the traditional office environment. The reaction of employees to this situation will be predictably ambivalent. On the one hand, it will induce apprehension - a fear of the unknown. Individuals are bound to wonder what automation will mean to their job security, job status, and level of remuneration. They will wonder what it will mean to their chances of advancement, whether they have the capability and flexibility to adapt to the occupational and organizational changes that will be required, and whether important friendship and social patterns will be disrupted by the change.

On the other hand, employees will wonder whether 'office automation' may present opportunities for new and more interesting work, what it will feel like to be associated with the glamour and modernity of an automated office, and whether increased productivity will be accompanied by salary increases. At the very least, there is likely to be a general feeling of excitement that at long last something dramatic is happening - for good or ill - that will relieve the tedium of the inexorable daily office grind.

The reason for this ambivalent human reaction to change may spring from a basic ambivalence in the human condition itself. Man is at the same time an individual and a social being. As an individual, he requires challenge, excitement and new experience. As a member of a social group, he requires security, recognition and rewarding human relationships.

This is the delicate human setting for the introduction of technical and organizational change. No matter how technically advanced the equipment is or how ingeniously the new system of work has been planned, a successful transition in human terms can only be accomplished if these individual and social dimensions are recognized and the welfare and satisfaction of the people involved awarded first priority.



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The Concept of 'Office Automation'

The concept of 'office automation' can usefully be approached as a subdivision of the general phenomenon of automation. During the past decade a lively controversy has been taking place between those who believe that automation is qualitatively different from mechanization - a second industrial revolution - and those who claim that it is merely an extension and speeding up of technical progress. With respect to 'office automation', too, opinions diverge widely between those who argue that automation will develop more rapidly and more dramatically in the office than in the plant and those who maintain that, whatever the future of the push-button factory, there are features of clerical work that rule out the possibility of the robot office.

Certainly factory mechanization enjoyed a long head start over the introduction of office machinery. At the turn of the century, when steam power had been driving the industrial mills for several decades, an accurate enough stereotype of the office clerk was still the black-coated male worker, replete with eyeshade and celluloid sleeve guards, penning neat copper-plate entries in an outsize ledger spread out on a high-top desk.

By the time of the First World War, however, the era of mechanization in offices had begun with the introduction of the typewriter - an innovation, incidentally, that triggered a revolution not only in correspondence but in the sex composition of the clerical labour force. In the succeeding two decades, office mechanization developed rapidly with the introduction of the adding machine, telephone, desk calculator, bookkeeping machine, cash register, dictating equipment, duplicating machines, and a whole range of other devices from mechanical letter openers to complicated machines for collating, folding, and addressing printed material.

Of all the types of mechanization introduced into the office in the period between the two wars, the most dramatic innovation was the punch card and its accompanying battery of keypunch

machines and verifiers, sorters, collators, reproducing punches, and mechanical tabulators. The punch card concept with its advantages of standardization, increased output, and improved quality control over clerical work - especially in accounting-type operations - caught on rapidly and the mechanical accounting or tabulating department is now a familiar feature of most larger Canadian offices. This is the aspect of the modern office that commentators are usually thinking about when they observe that the office is becoming more and more like the factory.

Even though mechanical data processing appears to have been more a matter of advanced office mechanization than automation, a number of installations were built around the concept of integrated data processing which is the hallmark of automation in the office. Indeed, from a theoretical point of view, these instances of integrated mechanical data processing might be a more appropriate point from which to mark the beginning of the transition from office mechanization to automation than the introduction of the electronic computer. However, there were limitations - more physical than philosophic - that inhibited mechanical data processing from treating the paperwork of the office as a continuous flow, e.g., the comparative slowness of the electro-mechanical hardware, its lack of flexibility, and the sheer physical problem of coping with the weight and bulk of punched cards. Even with modern card input computers, it is hard to resist a sotto voce comment about 'the wonders of automation' when one meets a programmer staggering down the hallway under the weight of two fully loaded punch-card trays!

In any case, it certainly seems reasonable to suggest that the cumulative impact of three or four decades of mechanical data processing in the office has been much greater than that of the computer in its short life to date. It is a pity that the employment, occupational, organizational and social effects of the mechanical data processing revolution had not been more fully and systematically documented. Such studies would have provided invaluable bench-mark data for evaluating the direction and extent of the effects of 'office automation'.

During World War II, the electronic digital computer - the most popular symbol of automation - was developed to facilitate scientific and engineering calculations associated with modern weapons technology. When the war ended, the applicability of a general purpose digital computer to the paper processing problems of modern business was realized. The first convincing demonstration of the ability of the electronic computer to handle large volumes of data at an unprecedented speed was the programming of the 1951 census in the United States.

Conceptually, the computer is a fairly simple mechanism that can recognize and add up discrete electrical impulses. The

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revolutionary features of the computer are first, that the vacuum tube and, more recently the transistor, allow calculations to be made at electronic speeds and second, that the development of information storage or 'memory' allows the computer to be programmed or instructed to perform logical decision-making functions at the lower performance levels of the human brain. The result is that electronic computers can accomplish complex scientific or engineering computations that would have required hundreds of man-years' work by traditional methods, or carry out the more straightforward processing routines involved in handling the vast quantities of paperwork that characterize the operations of the ordinary business office.

Although by no means all the 'bugs' have been ironed out of the general purpose business computer, the potential of electronic data processing is clear enough in the accomplishment of paperwork processing at unprecedented speeds, a high level of accuracy, dramatic reduction in clerical labour input, and new and improved sources of information for management decision-making. Nor is the tempo of technical development connected with computers slowing down. In the decades that lie ahead advances in common language programming, scanning devices for direct data input, and new developments in the fields of communications, photography and printing will undoubtedly extend still further the range of capacities and capabilities of electronic computers.

A description of the present and future capabilities of the computer by itself, however, won't answer the important question - whether electronic data processing heralds an era of true automation in the office or simply represents the most recent stage in the process of office mechanization - a new tool or machine that will perform the traditional office jobs better or faster.

To provide a perspective from which to approach this question, it may be helpful to consider the organizational evolution of the office. A hundred years ago, when enterprises were small, the limited amount of office work might be performed by the entrepreneur - the owner-manager - on a part-time basis or by a single clerk. The traditional clerk performed as a sort of human integrated data processing system, handling purchasing and inventory, correspondence, accounts receivable and payable, bookkeeping, the preparation of financial statements, accounting, banking and so on, and may have helped out in the shipping room or with counter-transactions in his spare time. The characteristics of the organization that made this approach to office work possible was its small size and the consequently limited volume of paperwork.

During the first stages of growth in the size of the enterprise, tradition probably ensured that the device commonly employed to cope with an increased volume of work, both on the shop floor and in the office, was simply to hire additional mechanics and

clerks, each performing the same sort of complete work cycle. If a cobbler could turn out a pair of boots in a day, ten cobblers would be employed to meet a daily demand of ten pairs of boots. Similarly, if a clerk could perform all the operations involved in handling a hundred accounts, ten clerks - each assigned a hundred customers - would be employed to service a volume of one thousand accounts.

By the early decades of the twentieth century, the efficiency of this 'additive' principle of meeting the demands of continued growth was challenged by the influence of the scientific managers - Taylor, Gilbreth, and Ford. The common principle to which these men adhered was that of increasing individual efficiency and raising output by means of breaking down complex, integrated tasks into simple, repetitive components. This 'segmental' principle, first articulated in relation to the individual worker, was soon reflected in the structure of the organization. The bureaucratic theory of organization, delineated by the German social scientist, Max Weber, in relation to government, became the normative pattern according to which growing organizations could systematically accommodate still further increases in growth.

The result was the modern hierarchical, segmental configuration of the organization, symbolized by the formal organization chart. The guiding principle in the bureaucratic organization was a functional one. Each of the major functions of the enterprise was accorded its own organizational structure and complement of personnel. This segmentation resulted in a whole series of separate departments for purchasing, production, sales, accounting, etcetera, and the work within each department was in turn broken down into functional sections or units. The work-flow through the organization was now channelled in logical sequence from department to department, each adding a stage of processing to the cumulating product. The same formal, line-channelling of the flow of work took place within departments as well as between departments and this mass production rationale became as much the rule for handling paperwork in the office as for production in the plant.

Such has been the organizational setting into which the great bulk of office mechanization has been fitted in the past fifty years. The introduction of office machines was designed not as a substitute for these organizational principles, but simply to speed up or increase the volume of work performed in particular departments or in discrete operations.

Departmentalization and the introduction of office machinery, however, have not solved the basic problems of large-scale organization, i.e., the problems of communication, co-ordination, and control. Indeed, these problems have tended to grow and become more complex with the corresponding growth of the organizations themselves. These are the problems - the delays, frustrations, bottlenecks, garbled signals and just plain red tape - that crop up

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continually in large organizations staffed by human beings: the sort of problems that the scientific managers did not take sufficiently into account.

A great deal of effort has been expended in trying to overcome or mitigate these problems - the development of staff positions to supplement the line organization, a proliferation of organizational roles such as administrative and special assistants, liaison officers and expediters, and the formation of interdepartmental committees, to name only a few. But the management problem in large-scale organizations remains, attested to by the incidence of heart attacks, nervous breakdowns, and the whole gamut of tension-induced 'dis-ease'.

This is the environment into which the electronic computer has been introduced in the middle of the twentieth century. In the present pattern of utilization a high proportion of computers probably simple represent a faster form of office mechanization - a super-speed tabulating machine for running traditional unit record routines.⁽¹⁾ But the computer's potential for integrating the operations of the large-scale organization and solving the problems of co-ordination and decision-making is revolutionary.

As an example of the common type of application, consider the company that installs a medium-sized computer to speed up the running of its payroll. The price paid for improved efficiency in this particular operation may be widespread change within the payroll department, but the structure of the organization will remain largely unaffected. This will remain true even if several other departments, such as purchasing or accounting, acquire similar equipment to facilitate their particular functions.

There are a few examples, however, of large organizations which are approaching electronic data processing from a quite different direction. Consider the combined operations approached that might be adopted by an insurance company. In such an approach the functions of the several departments - actuarial, accounting, premium billing, dividend calculation, calculation of agents' commissions, and so on, might be combined in a single integrated application, and the system designed to produce mortality statistics, statutory financial reports and a whole range of current and simulated information for management decision-making as by-products.

In such a situation where the full potential of a computer is utilized to perform the operations of a centralized, integrated system, the impact on the traditional structure of the organization is like a torpedo, cutting sheer across established functional and departmental lines. Whole departments, even vice-presidential empires, may be swallowed up in the wake of reorganization, rumps

(1) Cf. Garrity, John T. 'Top Management and Computer Profits'. Harvard Business Review. July-August. 1963. p. 8 ff.

of depleted departments may be combined into new organizational entities, while a new and powerful electronic data processing department emerges as the essential heartbeat of the organization.

When this happens, the evolution of the office will have turned full cycle, returning to the concept of the single clerk who could perform all the necessary processing on a limited volume of data, but with the human being now replaced by an automated clerk competent to perform a similar integrated processing function on a virtually unlimited volume of input.

Summing up, it seems reasonable to suggest that, as with automation in the factory, we are not yet clearly launched into an era of 'office automation'. We are still assimilating the effects of several decades of office mechanization, which include the majority of computer installations. But the introduction of the electronic computer with its potential for integrated data processing and information for management decision-making has brought us to the threshold of a period of dramatic and pervasive change in the traditional office environment.

★ 2 ★

The Scope of 'Office Automation' in Canada

There were 303 electronic digital computers in operation in Canada at July 1, 1962.⁽²⁾ This is more than three times the number of computers in Canada two and a half years earlier, at January 1, 1960. If the same rate of growth took place in the latter half of 1962, there would have been approximately 400 computers in operation in Canadian business, industry and government at the beginning of 1963.

However rapid the growth of computer installations in Canada may appear, it is a relatively modest picture compared to the situation in the United States. The number of computers operating in the U.S. at January 1, 1963 was 13,560⁽³⁾ and it is estimated that this figure will reach 20,000 by the beginning of 1964.

There are a number of factors that may help to explain this difference. First, there are proportionately fewer very large firms in Canada who may feel they can afford the high purchase price or monthly rental of the large-scale computers. Second, as clerical salary costs are generally lower in Canada, the potential salary savings represented by computers may have less appeal for Canadian customers. Third, computer prices in Canada are generally higher than those that obtain in the United States because of the tariff policy on computers and computer components. Fourth, many American organizations with Canadian subsidiaries may tend to centralize their computing facilities, both for data processing and scientific work, at parent plants or head offices in the United States. Finally, there may be an innate conservative trait in the Canadian national character that tends to inhibit the adoption of new methods and techniques.

(2) Canadian Department of Labour. Economics and Research Branch. Skilled Man-power Training Research Series. The Current Status of Electronic Data Processing in Canada. Report No. 9C. Ottawa. 1964. Data in this chapter are abstracted from this reference except as otherwise noted.

(3) Business Automation. January 1963. p. 42.

As would be expected, the distribution of computer reflected a heavy concentration in those areas in which business, government and industrial activity is centred in Canada. There were 5 computers in the Atlantic Provinces; 77 in Quebec; 158 in Ontario; 44 in the Prairie Provinces; and 19 in the Pacific region. With 80 computers operating in Toronto and 63 in Montreal, the two largest Canadian metropolitan centres accounted for just under one half of the total number of computers in the country.

In terms of distribution among major industrial groupings, manufacturing led with 98 computers, followed by community and business services with 67. Finance and insurance accounted for 45 computers, public administration and defence for 41. Transportation, communications and utilities operated 29 computers and wholesale and retail trade accounted for 20 electronic data processing installations.

It has frequently been suggested in the literature that one of the structural factors that will limit the scope of 'office automation' is that only large organizations will be able to employ computers, while the bulk of clerical workers are still employed in small offices. Probably the main factor in the spread of electronic data processing taking place among smaller organizations has been the appearance on the market of a number of smaller and less expensive solid state general purpose computers. There is, however, another trend which may carry electronic data processing to an even wider range of customers. These are the E.D.P. service bureaus, both those operated by the manufacturing companies and those run by independent commercial organizations, often in connection with a management or engineering consulting business. These service bureaus provide their clients with a wide choice of utilization ranging from simple renting time on their equipment to planning, programming, and running customer applications.

Summing up, electronic data processing got off to a rather slow start in this country. So far, while it is now enjoying a rapid rate of growth, 'office automation' affects only a small portion of the Canadian office scene, and its scope and impact to date certainly cannot be compared with the pervasive effects of several decades of office mechanization, particularly the punch card systems that are now a ubiquitous feature of all but the small offices in this country. On the other hand, it is equally clear that of all the systems and equipment changes affecting the office, the electronic computer - particularly where its full potential for integrated data processing is utilized - will represent the most dramatic and far-reaching of all such changes in the decades that lie ahead.

Impact of 'Office Automation' on Employment

The most widely shared fear of automation is associated with its potential negative impact on employment. Estimates of the direction and extent of this employment effect fluctuate wildly between claims that it will generate thousands of new jobs to compensate for the small number it may eliminate and dire predictions that it will eventually throw the bulk of the labour force onto the street. This same controversy surrounds the subject of 'office automation'. As recently as five years ago Fortune, Business Week and the Harvard Business Review were trumpeting the dramatic reductions in office personnel that might be expected from the electronic computer. Clerical staff savings used to constitute the first line of offence in the computer manufacturer's sales battery. But those unsophisticated days are now past, partly because the dramatic personnel reductions seem to have failed to materialize thus far and partly because such a public image is not a particularly desirable one in a decade plagued by the spectre of unemployment.

There can be little real doubt in anyone's mind that electronic data processing, like any other kind of automation or mechanization, is a move toward an intensification of the capital equipment side of the capital/labour input production ratio. It is, therefore, designed, among other things, to realize the same level of output with a reduced labour force or an increased level of output without a proportional increase in employment. Estimates of this potential, proportional employment saving vary widely from 10 per cent to 50 per cent, depending upon the nature and extent of the computer applications. A common estimate is that the introduction of a large-scale computer into a head office organization with 2,000 employees might be expected to eliminate 200 to 500 clerical jobs over a two- to five-year period, assuming that the volume of work remained constant.

The important questions to be asked about 'office automation' in the employment context, therefore, are: 1) What is the

short-term employment impact of the introduction of electronic data processing on the individual organization?; and 2) What is likely to be the long-range employment impact of 'office automation' on the local labour market and the clerical sector of the labour market as a whole?

The first question is much the easier of the two. It seems unlikely that the introduction of electronic data processing will occasion any wholesale layoff of clerical personnel at the level of the large individual firm enjoying a reasonable growth in its volume of business. Indeed, most firms that have introduced E.D.P. have given their employees a guarantee of job security. Such a guarantee to protect their reputation as good employers usually doesn't represent much of a gamble, given the extended period of time required for conversion to electronic data processing, the age and sex composition of the clerical work-force, and the ability to absorb redundant clerical workers in unaffected operational areas. In most large offices the great majority of the clerical employees are young, unmarried girls enjoying a twentieth century form of the dowry as they move from high school-leaving to marriage and child-rearing. Consequently, with the high rate of annual turnover that accompanies such an employment structure, the organization need only reduce or suspend its annual intake of new hires in order to cushion any negative employment effect.

Virtually all of the research studies on 'office automation' conducted to date have been at the level of the individual firm. None of these studies has revealed substantial clerical layoff attributable to the introduction of electronic data processing.⁽⁴⁾

A report published by the International Labour Organization, however, added two important caveats to this comforting picture: First, that the bulk of this satisfactory employment experience with E.D.P. on the part of large office organizations has occurred during a period of growth and general economic buoyancy; and second, that as electronic data processing spreads to medium-sized and smaller organizations there may be less possibility of absorbing redundant workers in other departments and greater pressure for staff economies in order to justify the investment.⁽⁵⁾

As well as its clear potential for eliminating large numbers of traditional routine clerical jobs, it should be pointed out that electronic data processing has also generated a number of new office

(4) Cp. Ida R. Hoos. *Automation in the Office*. Public Affairs Press. Washington, D.C. 1961. p. 31. United States. Department of Labor. Bureau of Labor Statistics. *Adjustments to the Introduction of Office Automation*. Bulletin No. 1276, Washington, D.C. 1960. p. 3.

(5) International Labour Organization. *Advisory Committee on Salaried Employees and Professional Workers. Effects of Mechanization and Automation in Offices*. Report III. Geneva, 1959. p. 53.

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occupations. At July 1, 1962, there were 3,437 people employed in full-time computer occupations associated with the 303 computer installations in operation in Canada.⁽⁶⁾ These included systems analysts, programmers, console operators, peripheral equipment operators, computer maintenance technicians and tape librarians. If the estimated 1,000 systems development and systems support staff employed by the computer manufacturers and distributors and the systems analysts and programmers already at work in organizations planning to install computers were added to this figure, the number of computer personnel would have been approximately 5,000.

An interesting glimpse into the office of the future may be gleaned from an analysis of these computer personnel. The more senior planning and programming positions constitute over half of the total number of computer jobs. Men occupy E.D.P. positions four times as frequently as women do and in the more senior jobs they outnumber females nine to one. The svelte blonde seated at the computer console - a sort of space age Kitty Foyle - is apparently more a creation of the advertising fraternity's imagination than a prototype of the office worker of the future.

In addition to these computer personnel, another 5,000 employees were working in jobs closely associated with the computer. These were 2,000 keypunch, verifier, and related machine operators employed full time in providing computer input and 3,000 data origination and data control clerks involved in preparing information for the computer and checking its output. These jobs do not represent new occupations created by electronic data processing and it should not be inferred that these categories imply a net increment of thousands of new and additional office jobs. Rather, they represent a conversion impact of E.D.P. on the traditional structure of office occupations through which the work of clerks and machine operators already in employment is adapted to the requirements of the new system and equipment. At this level, not surprisingly perhaps, females recoup, outnumbering the males by more than two to one.

In a case study the Department of Labour is conducting on the impact of the introduction of a large-scale computer system in the head office of a big insurance company, it has been found that the demand during the transition to electronic data processing appears to be for a good deal more rather than less clerical help. The reason for this is the vast amount of clerical work involved in preparing records for conversion to the new system, including the tracking down of errors, omissions and inconsistencies toward which the older system may have been somewhat more tolerant. Part of this extra clerical load has been handled through regularly scheduled overtime for existing staff but it has been necessary to

(6) Canadian Department of Labour. op. cit. Chapter III.

supplement this expedient by hiring additional clerical help — typically married women who find it convenient to work on a part-time basis.

Turning to a consideration of the pattern of the long-range impact of electronic data processing on clerical employment, the path is pocked by the myriad pitfalls that plague the forecasting art.

Throughout the urban, industrialized world, the occupational structure of the labour force has been changing rapidly in recent decades, marked by a dual decline in the proportion of agricultural and direct production workers in manufacturing and the primary industries and a rapid expansion of employment in the professional, technical and service occupations. The growth in clerical occupations has been one of the most important elements in the expansion of the service sector. In 1961 there were 820,000 employed in clerical jobs — 13 per cent of the civilian labour force, or one out of every eight Canadian workers. Three decades earlier in 1931, clerical employment made up $6\frac{1}{2}$ per cent of all Canadian workers, and only 3 per cent in 1901. It should be noted that through these decades the clerical labour force was one of the fastest growing sectors, consistently outstripping the rate of growth enjoyed by the labour force as a whole.

In addition to this dramatic increase in the size of the clerical work-force, the composition of clerical employment has changed from a predominantly male to a female work world. In 1901, 78 per cent of the Canadian clerical workers were male and, as late as 1931, men still slightly outnumbered women in clerical jobs. But, by 1961 over 60 per cent of the much larger number of clerical jobs were held by women.

The important question, of course, is whether this clerical labour force will continue to grow at the same rate in the decades ahead. The answer will depend on a complex of demographic, economic and technical factors of which electronic data processing is but one. A more reasonable question in the context of this discussion perhaps is whether 'office automation' will stimulate or inhibit future clerical employment, and what effects it may have on the composition of the clerical labour force of the future.

The fact that substantial layoffs attributable to the introduction of 'office automation' do not appear to be occurring at the level of the individual firm should not be construed as reassurance that E.D.P. will not curtail clerical employment opportunities in the decades that lie ahead. The reality of the matter may simply be that the employment effect of 'office automation' is 'hidden' rather than overt.⁽⁷⁾ If, for example, several of the largest traditional employers of clerical personnel in a particular community

(7) Cp. Hoos. op. cit. p.33. K. VanAuken, in *Man and Automation*. Yale University Press. New Haven, Connecticut. 1956. p. 30.

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had all converted to electronic data processing, the annual formation of new clerical job opportunities would almost certainly fall below the level of the supply of clerical recruits produced by the secondary school system. In this case, the unemployment effect of E.D.P. would be felt by the girl dropping out of high school who fails to secure a first job with the local insurance company.

Nor does it seem safe to assume that the new jobs created by 'office automation' will compensate for the curtailment of traditional clerical employment opportunities. In the first place, it is doubtful that the higher-level E.D.P. jobs will be filled by the same sort of people that now man the bulk of routine clerical positions. Many of those in programming work today are bright high school graduates but the hiring trend appears to be toward those with at least an under-graduate university degree. Further, recent developments in common language programming may result in a much more modest employment demand than was originally anticipated.

The same sort of considerations must be taken into account in assessing the future demand for keypunch operators and data clerks. The writing on the wall for keypunch and data typing personnel may have occurred in the processing of the 1961 Canadian Census where the enumerator returns were fed into a photo-electric reader which converted the data directly into computer input. Similarly, future technical improvement may increase the computer's level of accuracy and obviate the present visual checking procedures carried out by the data clerks.

As far as part-time personnel are concerned, the work generated for them by conversion to electronic data processing is a 'one-shot' rather than a continuing proposition. Hoos⁽⁸⁾ claims that the cumulative impact of E.D.P. has already cut down the number of part-time jobs, especially in peak seasons, in private business and government operations and this has directly affected the opportunities of a large number of women seeking part-time work.

The conclusion most often reached concerning the long-range employment effect of 'office automation' is that clerical employment will continue to grow in the foreseeable future, but that the rate of expansion experienced in recent decades will not be sustained.⁽⁹⁾

If this evaluation is essentially correct, it would appear to be a cause, not for complacency, but for sober and imaginative

(8) Hoos. *op. cit.* p. 34.

(9) J. Stieber. 'Automation and the White-Collar Worker'. *Personnel*. November/December, 1957. p. 16. G.M. Smith. *Office Automation and White-Collar Employment*. Institute of Management and Labour Relations. Bulletin No. 6. Rutgers University. New Brunswick, N.J. 1959. p. 12. International Labour Organization. *op. cit.* p. 52.

thought about our expanding population with large cohorts in the younger age groups, about the occupational orientation of the educational system and about the capacity of the tertiary sector to provide unlimited employment.

Impact on Clerks and Their Jobs

Professor Stieber neatly sums up the conventional wisdom about the internal impact of 'office automation', when he observes:⁽¹⁰⁾

'In general, labour leaders, businessmen and scientists seem to be agreed that whatever its effect on employment, the advent of electronic computers into the office will result in the upgrading of skills, the redistribution of the workforce in the shape of higher proportion of skilled jobs, and the virtual elimination of tedious, repetitive, clerical operations.'

It is undoubtedly true that the computer will have its greatest quantitative impact on the routine clerical jobs that constitute the broad base of the office hierarchy. Probably no one would gainsay this to be other than a potential blessing, provided more interesting alternative job opportunities are forthcoming.

It is equally true that E.D.P. introduces a number of new office occupations that demand relatively high educational qualifications and involve extensive specialized formal training. In the long run, therefore, this dual trend is bound to result in some upgrading in the occupational composition of the office.

What is far from clear, however, is the nature, extent and tempo of such an upgrading effect. Diverging from the popular stereotype, the majority of students of the effects of electronic data processing appear to feel that, if the era of the automatic office lies in the future, the office comprised only of interesting

(10) Stieber. op. cit. p. 11.

and challenging jobs, staffed by highly qualified and generously remunerated personnel, lies in the far distant future, indeed. (11)

A survey of the research literature indicates that the introduction of electronic data processing will create widespread displacement among those engaged in routine clerical operations in the departments and units affected by the change. Apparently the extent of this dislocation may involve from one third to 75 per cent or more of the clerical jobs, depending upon the nature and extent of the computer applications. A number of those displaced may qualify for the new computer occupations. A large group may be converted to data origination and data control clerks, or to key-punch and other machine operators, while others may inherit bits and pieces of other people's work combined into new clerical jobs. The balance of those affected will probably be transferred to vacancies at equivalent grade levels in departments not yet affected by the new system.

From the point of view of the organization, this widespread clerical dislocation, hectic as it may be for personnel departments in the short run, is unlikely to present many insuperable problems that cannot be solved by a flexible company-wide transfer policy and short periods of informal training for the new jobs.

From the point of view of the displaced clerical employees themselves, however, the problems may be much more serious. Some employees may have to accept demotion to lower grades and salary levels to retain employment, others may be threatened with further dislocation if they are transferred to areas of the enterprise to which computer applications are subsequently applied, and many may find that their chances for promotion are diminished by a flattening out of the clerical hierarchy and by lateral transfers that block expected promotion chains.

But the most important problems are probably those of a social and psychological kind that seem to receive a great deal less attention than their importance warrants. One empirical study of employee attitudes to technological change in the office has been carried out in a medium-sized insurance company through the administration of questionnaires filled in by several hundred clerical and supervisory employees. Technically immaculate, replete with chi-square and 'other tests of statistical significance', the research study tells us that ordinary office workers are ambivalent in their

(11) Cf. *Ibid.* p. 16. International Labour Organization. *op. cit.* p. 80., Hoos. *op. cit.* p. 57., Floyd C. Mann, and Lawrence K. Williams, 'Organizational Impact of White-Collar Automation'. *Proceedings of the Eleventh Annual Meeting of the Industrial Relations Research Association.* Chicago. December 28-29, 1958. pp. 65-66., VanAuken. *op. cit.* p. 31. and C. Bureau of Labor Statistics. *op. cit.* pp. 4-5. H.F. Craig. *Administering a Conversion to Electronic Accounting.* Graduate School of Business Administration. Harvard University. Boston, Mass. 1955. pp. 69-70.

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reaction to the prospect of change but can apparently be counted on not to engage in organized sabotage. A session with the office nurse or with a selection of medical practitioners and psychiatrists in the local community would have proved far more rewarding in revealing the conflicts of fears and hopes that office workers bring to their workaday world.

There are serious potential problems of employee motivation and morale that flow from the social and psychological repercussions of change. The office is an informal social organism as well as the economic entity and formal organization mirrored in the company chart. For these clerical employees, as with all of us, the job is not only the primary source from which we derive our income and status as individuals, but is one of the important environments in which, as social beings, we build up meaningful human relationships. These employees have important emotional vested interests in friendship patterns and informal group relationships. Sometimes these informal arrangements tend to inhibit or subvert the goals of the formal organization. But more normally, these solidary and helping relationships coupled with a natural instinct of workmanship are primary factors in overcoming the bureaucratic hurdles which often obstruct the realization of corporate goals.

The organization that is insensitive to these socio-metric relationships or the management that chooses to utilize our meagre knowledge of human motivation and behaviour in work situations to manipulate or 'adjust' its employees to technological and organizational change may well fear for the success of its new system. More than this, the organization that approaches the break-up of established informal work groups with a light heart and a careless touch and fails to take these individual and social needs into account in structuring the new patterns will prove a failure in its important role as a human as well as an economic institution.

Conversely, the organization that has consistently demonstrated its concern for the dignity and psychological integrity of its employees in periods of both stability and change, can look forward with confidence to a smooth transition to 'office automation'.

Impact on Clerical Supervisors and Older Workers

It is at the level above the bulk of the routine clerical work-force - the clerical supervisors and long-service personnel in senior clerical positions - that the problems introduced by electronic data processing are causing most serious concern. During the process of conversion and parallel operations, the pressure on supervisors and key clerical personnel is acute. In fact, there are two jobs simultaneously demanding the full-time attention of each such employee: maintaining that part of the old system for which he is responsible, usually with a reduced staff; and converting to the new system, likely with the additional pressure of having to train new personnel.

But when the new system becomes operational the situation is reversed with two supervisory candidates or senior clerks for each available opening. The reason for this is that one of the most important organizational impacts of electronic data processing is the way in which it flattens out the supervisory hierarchy and widens the span of control. This effect occurs not just because the computer can handle large volumes of routine clerical processing at electronic speeds but also because routine decision-making - which, together with discipline and training, has traditionally constituted the justification of the supervisory role - can now be programmed into the computer.

The upshot is that the case of each displaced supervisor and senior clerk will have to be treated on its individual merits. There is no single policy that will provide a panacea at this level. Obviously, laying off employees with years of seniority won't be an acceptable solution to companies with a good employer reputation to protect. Voluntary quits seem an unlikely solution on the part of those whose skills and subject matter knowledge are specific to one organization and who have built up large stakes in company retirement security schemes.

In spite of long years of trained incapacity for successful occupational adaptation, a few such employees may have retained enough flexibility to be retrained for computer occupations or liaison roles between the computer centre and clerical departments. For the majority of these displaced senior employees, however, an attempt will have to be made to facilitate transfers to equivalent supervisory or senior clerical positions in the other departments unaffected by E.D.P. This solution, however, is not as simple as the mass transfer of routine clerical workers, because only a few such equivalent positions can be expected to fall vacant through death or retirement.

In many cases, therefore, expediency may dictate the transfer of redundant supervisors and older workers to routine clerical work in other departments with or without a reduction in salary. In either case, the effect on the self-confidence and morale of the individual will be predictively negative - perhaps even disastrous. In the case of a small proportion of older workers within a few years of superannuation, exploring the possibility of early retirement at full or reduced pension may seem a more promising course from the point of view of the company. For the individual living in a work-centred society, such a solution may be regarded as rather less than ideal. From the point of view of the society as a whole, it represents a shifting rather than a solution of the problem.

In sum, it seems quite clear that it will be the older worker, both male and female, in clerical supervisory and senior clerical positions who will have to bear the brunt of the negative impact of 'office automation' unless a determined, imaginative and flexible effort is mounted through counselling, placement, and retraining. No amount of effort or ingenuity expended in helping these older employees caught in a difficult situation not of their own making could be considered wasteful in human terms.

Effects on Conditions of Work and Employment

The physical conditions of work in the modern office environment have certainly come a long way from the small, dark and dusty cubbyholes of the turn of the century. While the explosion in clerical personnel probably still results in undesirable overcrowding in downtown office locations, improvements in lighting, ventilation, temperature control and employee facilities have resulted in a general and marked improvement in the physical working conditions of office employees. Conditions of employment have also been greatly improved with greater job security, shorter hours, paid vacations, rest pauses and pension plans.

The growing problems of mental fatigue and nervous tension, however, are probably associated rather less with the physical conditions of work than with the content of jobs and the organizational arrangements under which work is performed - the monotonous, repetitive nature of the work cycle, work measurement and production quotas, authoritarian supervision, machine pacing, deadlines, peak loads, and so on. There is some reason to believe that office mechanization has exacerbated feelings of pressure, depersonalization, and anomie.⁽¹²⁾ Hoos⁽¹³⁾ quotes a supervisor of keypunch operators as saying: 'If you just tap one of them on the shoulder when she is working, she'll fly through the ceiling'.

It is probably too early to tell whether the net effect of 'office automation' will be to increase or reverse these tendencies. The reduction or elimination of the most routine clerical operations should help to mitigate the problem. On the other hand, for the short-run future at least, the proportion of machine-attendant positions with which these syndromes are commonly associated seems likely to grow. A large segment of these jobs consists in

(12) International Labour Organization. op. cit. p. 92.

(13) Hoos. op. cit. p. 23.

that strain-evoking trigger-attentive idleness that is the hallmark of the monitors of automation and advanced mechanization.

The most striking change introduced by electronic data processing into the traditional office environment is the appearance of shiftwork. Thus far, the impact of rotating and permanent night shiftwork appears to be largely restricted to operating and maintenance personnel.

In view of the medical, psychological and social evidence concerning the negative human effects of shiftwork, it would be useful to reassess this dimension of automation before it is uncritically accepted as a norm of office life. At the very least, groups of younger and older workers should be protected against its most blatant on- and off-the-job effects.

A first step in coming to grips with our pressing problems of occupational mental health would be to frankly admit the magnitude, endemic nature and social dynamite involved in what Karen Horney refers to as 'the neurotic personality of our time'.⁽¹⁴⁾ Second, we should consider the possibility that the way in which we sometimes organize sectors of the work community may be a significant contributor to this malaise. And third, we should develop imaginative action-research experiments in this area. Sometime in the future, automation may solve such problems for us. For the foreseeable future, however, the answer lies in a greater understanding and will to improve the human environment of work.

(14) Karen Horney. *The Neurotic Personality of our Time*. New York. Norton. 1937.
299 pp.

Implications for Management

The most dramatic impact of electronic data processing is probably reserved for the managerial occupations. Simon prophesied in 1960 that:

'During the next twenty-five years, the job of the manager will undergo some major changes, as machines take over more and more of the activities that now seem too complex and "high level" ever to yield to automation. The chances are strong that, even before this decade is over, machines will be able to perform any functions in the organization - and this includes the "thinking" and "deciding" tasks that are the basis of the manager's job.'⁽¹⁵⁾

Perhaps the most interesting area of speculation concerns the impact of the introduction of a large-scale integrated data processing installation on the structure of the organization and the nature of the executive power struggle that is likely to ensue.⁽¹⁶⁾ Consider the case of the traditional organization consisting of five or more major divisions, each headed by a senior executive reporting to the president or managing director. In this sort of structure, where the organization divides along functional lines, status, power and remuneration will normally have been more or less equally distributed among the several vice-presidents.

(15) H.A. Simon. 'Management by Machine'. *Management Review*. November, 1960. p. 12.

(16) Cf. R.E. Slater. 'Thinking Ahead: How near is the Automatic Office?'. *Harvard Business Review*. March/April. 1958. pp. 164-166.

Now, assume that the application of the computer is designed to integrate the major operations of the several divisions. The important question then becomes which executive will gain control of the new technology and its complement of organizational and personnel resources? In the emerging organizational structure in which the computer has become the operational heart of the enterprise, the winner in this power struggle emerges with no peer in the organization save the chief executive himself. The several candidates who 'also ran' or declined to compete are bound to suffer at least a relative loss of power and status as their empires shrivel in size and importance or disappear completely.

In some organizations, of course, these political problems will have been anticipated and strong resistance to this integrated concept may develop. Emphasis may be placed on utilizing smaller computers to decentralize operations or fitting the machines to the traditional organizational structure by awarding smaller capacity computers to each of the several divisions. But, it seems safe to prophesy that the integrative concept of automation will triumph in the long run.

The impact of 'office automation' on middle management is likely to be equally sweeping, if less dramatic. As the organizational pyramid is flattened out, a smaller number of middle managers in line positions will be required.⁽¹⁷⁾ At the same time, new developments in information technology will be creating more management associated jobs which may be classified at the middle management level. In other words, the impact of 'office automation' on middle management will likely be a differential one, reducing those positions where the functions have been primarily supervisory and expanding and creating new types of technical, professional and staff positions.

It is too facile, however, to suggest that the personnel in these two middle management cadres are easily interchangeable. It is in fact more likely that 'office automation' will have a substantial displacement and downgrading effect on present line middle management and that the demand for expanded numbers of staff specialists will be recruited externally, particularly from university-trained personnel.

There is one group of new middle managers whose individual and collective prestige and influence will accelerate rapidly with the introduction of the new system - those in the top echelons of the E.D.P. hierarchy itself. Their new-found power springs not only from administrative control over the centralized operations of the enterprise but from their monopoly of the technical expertise required to keep the system functioning.

(17) Leavitt, Harold J. and Thomas L. Whisler. 'Management in the 1980's'. Harvard Business Review. November/December. 1958. p. 41 ff.

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When an integrated E.D.P. system has become the central focus of the company's operations, higher management is almost totally dependent upon the key individual or individuals who have the technical ability to operate the system. Even in an era of experts and specialists, this situation in which the figure of formal authority is so completely dependent upon the subordinate with a monopoly of technical knowledge must be all but unique. What makes top management so vulnerable in this situation is that executive command may be met with a courteous explanation that its execution is not technically feasible.

A new generation of managers with a greater background in electronic data processing knowledge and further developments in common language programming techniques may change the feelings of trepidation and bewilderment with which many of the present generation of top managers must face the new breed of computer experts. Equally, electronic data processing may prove to be a new organizational ladder on whose rungs the next generation of senior management is even now ascending to scale the executive heights. A caveat to this picture derives from our research which demonstrates that in several cases older top executives have proved equal to the challenge of acquiring a basic understanding of the capabilities of the new system and equipment and relating this knowledge to corporate objectives. These men are presently firmly and happily in control of successful E.D.P. systems.

The most important potential of the electronic computer for the long-run development of top management lies in the field of information for decision-making. When the immediate large-scale clerical economies failed to materialize as a result of the introduction of E.D.P., more emphasis began to be placed on the computer as a sophisticated generator of information technology.

The role of the computer in the field of information technology is a dual one: on the one hand, extending and speeding up operations research and linear programming for improved current operational decisions; and, at the same time, introducing a quite new type of information, heuristic programming - using the computer to simulate the reaction and behaviour of complex systems and processes when new or changed stimuli are introduced. The computer as a chess player is a widely publicized example of the latter type. A more pertinent illustration of the relevance of this new type of information for policy decision-making is the so-called 'business games' played on computers which appear to be receiving a growing place in management training curricula. While the results of operations research have by this time won recognition in most larger and progressive businesses, the more esoteric applications are still largely developmental and experimental.

Since the majority of today's top managers have built their reputation on the basis of their experience, judgment and intuition,

it would not be surprising to discover that the greatest apprehension about the acquisition of the computer would be experienced at the top rather than the bottom of the organization. Fortunately or unfortunately, clerks appear to be more accessible to research than vice-presidents, and the literature on these problems is remarkably meagre. There is only the odd hint that E.D.P., at least in its introductory and transitional phases, is adding its quota to the cumulative level of management tension, such as that interjected by Hoos:(18)

'Many important officials implied that they really did not know what the whole business was about but that they guessed it must be pretty wonderful. Others stated their doubts only in the deepest confidence, for they said, not to "go along" with this thing would put them in the class of "old fogies", opposed to progress.'

While the integrated electronic data processing system must have the support of top management in order to succeed, there is some reason to suggest that the potential of the computer as an aid to management decision-making will be realized more fully by a future generation of managers. The reason for this is that the specifications for the sorts of information that prove most useful for top level decision-making must in the last analysis come from the managers themselves. Such an ability in turn requires a knowledge of the capacities and capabilities of the new equipment at a more profound level than that which can be picked up in the typical one-day or one-week orientation course for executives.

The challenge E.D.P. poses for senior management is a tough one - requiring the courage to accept the additional short-term strain of taking sufficiently extended blocs of time to educate themselves up to a firm grasp of the implications and potentials of the new equipment and methods in order to realize the long-run advantages of improved communication, co-ordination and control.

(18) Hoos. op. cit. p. 85.

Implications for White-Collar Unionization

Trade unionists are generally ready to concede that technological change and automation in the factory are gradually eroding the blue-collar ranks which have traditionally constituted the broad base of trade union membership. To maintain the numerical strength of the movement, many trade union leaders have been looking hopefully in the direction of the rapidly expanding white-collar labour force.

Introducing an essay on white-collar unionism in his classic analysis of the new middle classes, "White-Collar", the late C. Wright Mills quotes Mr. Samuel Gompers as saying: 'Show me two white-collar workers on a picket line, and I'll organize the entire working class'. (19)

Since that statement was made thousands of white-collar workers have formed picket lines and joined blue-collar workers on other picket lines. Powerful clerical and white-collar unions have been formed and many of the industrial unions have launched successful organizing drives among the office workers in their industries. But it is no secret that the results have been disappointing and that only a small fraction of clerks and white-collar workers in this country belong to trade unions. (20)

In only two or three industries - railroads, bus transport, telephone and municipal government - are approximately half of the office employees covered by collective agreements. And in the railroad industry, for example, this organization had been accomplished long before the companies had introduced electronic data processing into their office operations. In only half a dozen other industries

(19) C.W. Mills. *White Collar*. Oxford University Press. New York. 1951. p. 301.

(20) Canada. Department of Labour. Economics and Research Branch. *Working Conditions in Canadian Industry*. Ottawa. 1962. 170 pp. Cf. Tables 2, 6, 9, 11, 13, 15, 18 and 19.

such as the electrical, printing, transportation equipment, paper, airline, hydro electric, radio and television industries are there more than 10 per cent of the office employees covered by agreements. Particularly striking is the fact that in the large clerical corps connected with wholesale and retail trade, banks, and especially insurance companies - where the adoption of electronic data processing has proceeded furthest - the rate drops off to 1 per cent or less.

A great many explanations - economic arguments, psychological and social factors, and institutional reasons such as management resistance or lack of adequate organizing drive on the part of the trade unions - have all been advanced to explain the relatively unsuccessful history of white-collar organization. At present, the advent of 'office automation' has sparked a new and excited round of argument, counter-argument and speculation concerning the future prospects of white-collar unionism.

The comments appear to be about equally divided between those who feel that electronic data processing will foster clerical organization and those who feel that it will make the trade union's task more difficult.⁽²¹⁾ On the one hand, it is argued that office mechanization and automation will condition clerical workers to a readier acceptance of the advantages of collective action because the introduction of machinery and expansion of machine-operator jobs blur the traditional distinctions between the office and the factory, vitiate the aura of personal association and identification with management, and introduce a degree of rationalization, including the introduction of shiftwork, which makes the quasi-professional posture of the clerk untenable. Above all, it is contended that the fear of unemployment generated by 'office automation' will persuade white-collar employees to seek job security through trade union membership.

On the other hand, perhaps the single most important obstacle to widespread clerical organization in automated offices, as in their mechanical predecessors, is the syndrome of psycho-social attitudes associated with prestigious status and social class identification.⁽²²⁾ Automation may threaten the traditional objective bases that conditioned many of these attitudes - the gradual reversing of traditional white- and blue-collar income and fringe benefit differentials, routinization of the job content of clerical work, and the narrowing of promotional opportunities into management positions. But there are good psychological reasons to suggest that

(21) Stieber. op. cit. p. 16., Smith. op. cit. pp. 19-20., Wood, W. Donald. 'The Changing Environment of the Office: Retrospect and Prospect'. Canadian Personnel and Industrial Relations Journal. January 1960. p. 30. International Labour Organization. op. cit. p. 106.

(22) Cf. Mills. op. cit. Chapters IV, IX, XI, XIII and XIV., Hoos. op. cit. pp. 57-58.

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attitudes may be clung to even more tenaciously as the differentials that produced them become increasingly marginal. Indeed, such an attitudinal lag may persist long after the conditioning experience has disappeared completely.

Both management and trade unions have demonstrated an intuitive understanding of the situation and have shown a good deal of ingenuity in attempting to channel such motivation to their respective advantage. But these attitudes, rooted as they are in the prevailing value system, are not subject to easy or quick manipulation.

If the value system itself undergoes change, however, attitudes and consequently institutional orientations and allegiances may also begin to change and shift. If, for example, the economy awards priority to recruiting and training a larger proportion of its labour force for skilled and technical tasks, and implements this priority through subsidization of training and premium incomes for such occupations, these changing economic realities will gradually modify the pattern of occupational preferences that parents have for their children. If and when large numbers of children from middle class homes begin to opt for the technical high school and the electronic technician's bench in preference to academic matriculation and the teller's cage, a revolution will also probably take place in the composition and attitudes of the white-collar labour force.

What such a volatile situation would mean for the future of white-collar unionization is, of course, a matter of speculation. A great deal would depend on whether the trade union movement would be able to retain or capture the loyalties of the emerging 'grey-collar' technical groups. If these new groups were organized collectively within the bonds of the trade union movement, the effect on the attitudes of tomorrow's generation of clerical workers toward trade union membership might be both widespread and dramatic.

However, there appear to be three main problem areas which may inhibit widespread clerical organization in the automated offices of the future. First, there are the limitations likely to be imposed by the future size and shape of the clerical labour market. The current belief in the ability of the tertiary employment sector to soak up any degree of redundancy occasioned by automation in the primary and secondary sectors is probably a dangerous exaggeration. Therefore it would be folly to assume that there will be a new white-collar worker waiting to be organized for every blue-collar worker lost to the union roster. The reason for this, as demonstrated by the effect of 'office automation' on clerical work, is that many areas of the service sector lend themselves particularly advantageously to the labour-saving features of automation.

Second, the negative employment impact of 'office automation' is likely to be of a hidden rather than an overt nature. This means that the potential entrant to the clerical labour force may

experience unemployment even before he secures his first job - let alone have an opportunity to take out a trade union card. The result is that the trade union, based on the membership of employed workers, may have no way of encompassing the support of the potential white-collar group that is psychologically best prepared for collective organization and action.

Third, it has been suggested that widespread white-collar organization could be more effectively promoted by organized labour on an 'institute' or 'professional' rather than a trade union basis. Given the age and sex composition of the white-collar group and the high turnover among routine clerical workers, however, there seems some reason to suggest that the lack of a lifetime career orientation might limit the success of such a strategy. But even if such an approach were successful beyond reasonable expectation, there is a problem of invidiousness implied that might produce a devastating 'class cleavage' within the trade union movement itself.

Perhaps the best illustration of the changing situation taking place in the office concerns one of the important new occupations created by 'office automation' - the computer programmers. Their present situation is an ambiguous one. It is not at all clear whether they regard themselves as a new breed of clerical workers, the technicians of the modern office, or a new entry into the mushrooming list of professions. Moreover, their relationship to management is still amorphous. Whether the programmer's role will be accommodated within the structure of management or developed as a separate specialty or profession is not yet clear. If the latter, it is equally uncertain whether such a professional or sub-professional group would affiliate itself with the trade union movement as a whole or choose to remain aloof and independent.

Such a question, however, may prove to be more hypothetical than real. The reason for this is that programming may demonstrate the startlingly stepped-up tempo of occupational change in the office. Even before this new occupation is fairly launched, the seeds of its early obsolescence may have been sown by still further technical advances in assembly, compiling, and common language programming techniques.

The ultimate fate of programming may be a harbinger of the long-range impact of automation on the structure and functions of the trade union movement. If the long-run effect of automation is to displace the institution of work from its central position as the governor both of production and distribution, the trade union, like its management counterpart, will undergo a profound and difficult period of adjustment and reorientation. How rapidly or extensively automation will vitiate the traditional emphasis on collective bargaining, and what the new or additional trade union functions will or should be - political activity, education, organization of consumers, welfare, recreation, etcetera - are well beyond the scope and competence of this paper.

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Conclusion

From the relevant literature, our own research experience, and talks with many persons who possess a wide practical experience in this field, it is becoming possible to present some conclusions in the form of tentative guidelines for successful transition and adjustment to 'office automation'. Such a list might include:

1. Successful introduction of a large-scale integrated electronic data processing system, affecting more than a single sector of the organization, requires the authority and support of top management.
2. Arrangements should be made for early, full, and continued communication about the new system and 'consequent' organizational changes to personnel at all levels of the organization.
3. This communication process should include consultation with trade unions or other forms of employee representation where such exist.
4. Such communication should include as high a measure of employee reassurance as can safely be guaranteed concerning security of job, grade and salary.
5. Wherever talent can be developed through training, selection of and promotion to the new jobs created by the system should be made from employees within the organization.
6. Careful advance planning of hiring policies and practices should be undertaken to anticipate subsequent employment effects. For example, transitional build-ups of clerical staff should be recruited on the basis of part-time work and other non-permanent arrangements.

7. The placement and retraining of displaced clerical employees should be directed toward securing equivalent positions for them in other areas of the organization.
8. Special attention and consideration should be directed toward finding satisfactory individual solutions for the difficult problems faced by older clerical workers and supervisors whose positions have become redundant.

Above all, the success of the adjustment process will be conditioned by the traditional climate of management-employee relations within the organization.

All the points on shorter or longer lists of this sort are true and they are obviously good and useful things to do. But it is quite unrealistic to expect precepts and admonitions of this kind, by themselves, to solve the organizational and personnel problems introduced by 'office automation'.

The important lesson to be learned from automation is not that our technological progress has been too rapid but that our human values and social institutions have not been adequately developed to meet the challenge of the new environment. This is as true with respect to the world at work as it is to other institutions in our society.

The challenge of automation does not appear to lie in piecing together bits and pieces of human wreckage that an inexorable robot leaves in its wake. The real challenge lies in marshalling our resources of imagination and courage to take advantage of the momentum of change introduced by automation to enhance the human dimensions of the work environment.

Conceptually, this means that we must reverse the machine-over-man emphasis that has been allowed to creep into some areas of our industrial society. In terms of practical personnel policies, the challenge and opportunity introduced by automation may involve job rotation, job enlargement, and increased opportunities for employee participation in decisions that affect their work and their well-being.⁽²³⁾ At this stage, the specifics are less important than the development of an experimental orientation - commitment to discover more satisfying work contexts and a crusade against boredom, anxiety and alienation that reduce both efficiency and satisfaction in our plant and office pyramids.

Despite the mounting indications that we are paying a steep and dangerous human price for failing to translate the philosophy of democracy into a viable ethos of everyday life both on and off the job, resistance may be encountered to the new sorts of personnel

(23) Georges Friedman. *Anatomy of Work*. Free Press. New York. 1962. 203 pp.

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and manpower concepts and practices that will be required as we move toward automation. Indeed, a school of thought has already developed which suggests that a more authoritarian pattern of work relationships may be more appropriate to an age of automation than the permissive approach of the human relations school.⁽²⁴⁾ The advent of automation with its attendant problems and heightened tensions is bound to increase the very human appeal of deceptively simple solutions to complex human problems.

However, the idea that the human personality can be neatly divided into two watertight compartments - one to adjust maturely to a depersonalized work situation; the other to develop creative and satisfying individual and social leisure pursuits - is simply to encourage the creation of split personalities on a mass scale. Such a 'meat cleaver' approach to the problems of human beings at work would prove even more inappropriate to the decades of transition that lie ahead than it has in those instances where it has been put forward as a solution to problems of mechanization.

Automation may provide an opportunity to mitigate some of the traditional problems associated with human work in large-scale organizations. It will also certainly introduce some brand new problems of its own. In the long-run future, automation may sidestep these problems all but completely simply by eliminating the bulk of traditional human labour.

But the most important challenge posed by automation during the transitional decades that lie ahead are the problems of human beings in a changing world of work. There are two choices: a cautious rearguard action, which attempts to mop up in the wake of technological change and assuage as much human damage as possible; or a frontal attack, which makes use of flexible advance planning and imaginative experimentation, in a major effort to retain and elevate the human significance of work.

By building a work environment that fosters the development and maturity of the individual, we will be laying a sound human foundation for a future society in which automation and leisure may play increasingly important roles.

(24) M.P. McNair. 'What Price Human Relations?'. Harvard Business Review. March/April, 1957.

